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Concept Cartoons Assisted Problem Based Learning Method in Science and Technology Teaching and Students' Views

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Abstract

This study discusses the use of a problem based learning method with concept cartoons in science and technology teaching and gives scenarios and examples of concept cartoons. Besides, the students' views, about the effects of concept cartoons in assisting their learning process of problem based learning, was determined after the application was carried out on sixth class students. Semi-structured interviews were carried out with 27 students. From the results of the data analysis, it was concluded that all the students had a positive view about the effects of concept cartoons in assisting their learning process of problem based learning.

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1. Introduction

Problem-based learning (PBL) is a student-centered, independent, self-directed learning style which is guided by a facilitator (Abou-Elhamd, Rashad and Al-Sultan, 2011). In PBL, the students self-direct the learning process which is more problem-directed than teacher-directed (Sockalingam, Rotgans and Schmidt, 2010). In fact, PBL was developed originally for adults, in order to train doctors in how to approach and solve medical problems (Delisle, 1997). In 1969, a first group of 20 medical students arrived at McMaster University and were engaged in a process of learning and instruction which was called PBL (Schmidt et al., 2009). The approach was used first in medical education and, since then, it has been used in various fields such as the law; the economy; and management and social sciences (Demirel and Turan, 2010).

PBL is one of the methods, based on a constructivist approach (Lim, 2009) in which students work in collaborative groups to identify what they need to learn. This is done in order to solve a problem; engage in self-directed learning; apply their new knowledge to the problem and reflect on what they learnt; and the effectiveness of the strategies employed (Şahin, 2010). Consequently, in a PBL environment, problem solving is the goal of learning and is, also, the method of learning (Chen, 2008). The problems, which are used in the learning process, are real-world problems which students meet in their daily lives (Goodman, 2010). The aim of the PBL method is to stimulate the students to solve realistic problems; to work cooperatively; to activate higher cognitive levels; and to organize their own learning process (Woltering et al., 2009). Therefore, a PBL environment requires a search for information; management skills; and verbal and nonverbal communication skills (Ääri et al., 2008). PBL tends to

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shift the traditional student and teacher roles. Whereas, generally, the teacher identifies the academic topic for study, students decide which specific learning issues to pursue (Ertmer et al., 2009). Generally, in the PBL process, students are responsible for their own learning (Chan, 2009). In this process, teachers, guide and allow students to develop their own discussions (Maudsley, Williams and Taylor, 2008). The teacher plays, also, an important role in evaluating all learning process. Similar to other active learning method, the PBL method attaches, also, great importance to evaluating the learning process. Process evaluation is an integral part of each tutorial session and culminates, at the final session, with an evaluation of the case; the learning resources; the tutor/facilitator; the group; and the student (Chaves et al., 2006). As tutors, the teachers manage the evaluation process. Whereas the students evaluate the tutor; themselves; and sessions, the tutor evaluates, according to certain standards, the students throughout the learning process.

The PBL method aims to promote student-centered learning; to enhance the development of students' higher-order thinking; and to foster the students' social skills (Azer, 2009). By supporting various techniques, it is regarded, also, to be more effective for students at different levels. On reviewing the investigations, included in literature, it was seen that the PBL method was used with computer support (Belland, 2010); simulation (Liaw et al., 2010); internet (Lou et al., 2010); technology (Ertmer et al., 2009); and concept mapping (Hsu, 2004). Concept cartoons are one of the visual tools which are able to be used in a problem based learning environment.

Concept cartoons were designed, firstly, for adults and were used on posters, in London underground, in order to teach science concepts to adults (Keogh and Naylor, 1999). Then the research discusses the effects of concept cartoons prepared for students. Concept cartoons are cartoon style drawings designed as a stimulus to question; to intrigue; to provoke discussion; and to generate scientific thinking (Long and Marson, 2003). In the curriculum, concept cartoons which included two or more caricatures, focused on science-specific questions (Naylor, Keogh and Downing, 2007). Since problems, in daily life, are central to them, it is thought concept cartoons enhance inquiries and discussion; and develop scientific thinking (Morris et al., 2007). Concept cartoons help teachers to grasp their students' conceptual development provoke the students to learn; and keep them interested (Huang et al., 2006). The application of the process of concept cartoons, in learning environment (Cengizhan, 2011), meant that concept cartoons were presented to students so that they investigated and discussed the accuracy of the opinions included in cartoons. The students' opinions on the cartoons are reinterpreted in the results of the research findings.

Consequently, concept cartoons are visual tools which draw the students' attention; help to solve problems which they meet in their daily lives and provide the students with alternative ideas. For that reason, this study aimed at presenting the example of activity about using concept cartoons in the learning process in order to enhance the students' motivation and gain their attention by guiding their discussion by presenting alternative ideas and making it easier for students to solve problems. In addition, this study determined the students' views about concept cartoons assisted problem based learning method.

2. Research Method

This study was descriptive research. It presented the example of concept cartoons assisted problem based learning method. Besides, an application with 27 secondary students, lasting 4 weeks, determined the students' views about concept cartoons assisted problem based learning.

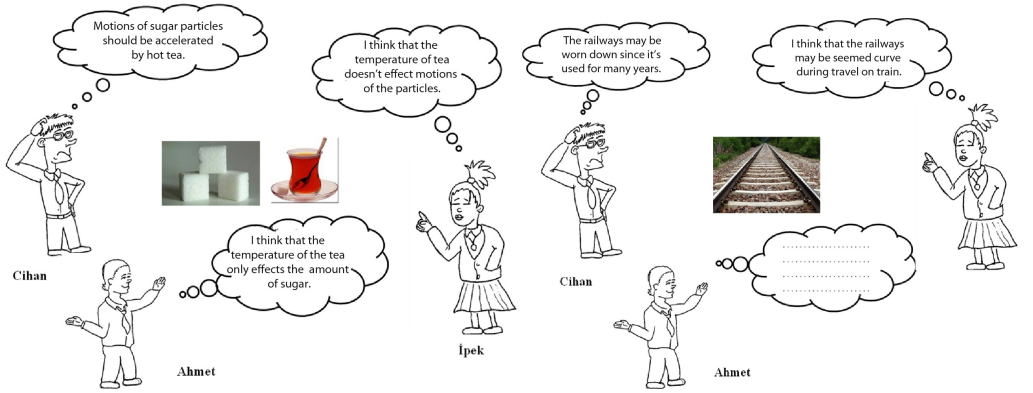
3. An Example of Activity about Concept Cartoons Assisted Problem Based Learning

In the first session, This module was aimed at the students ' learning of the effects of heat on particles formed matter and, in the second session, the students' learning of the correlation between heat transfer in matters and collision of molecules. Module preparation consisted of two sessions; each session included a scenario and concept cartoons about the solving of problem in that scenario. The scenario, included in the first session, was presented as follows.

> On a hot summer morning, Özge, with her mother and father, went by train to visit her aunt in Ankara. Özge was very happy about taking a journey with her family. In the course of the journey, Özge decided to drink tea with her mother. However, since the weather was very hot, Özge added cold water to her tea. Özge and her mother drank the tea with a cube of sugar. Both of them, at the same time, put in a cube of sugar and waited without stirring. After a while, Özge realized that the sugar, in her mother's tea, had dissolved quicker

and she was surprised by this event. Despite putting in a cube sugar to their tea at the same time, she did not know why a cube sugar had dissolved quicker in her mother's tea.

Afterwards, this scenario was presented to students who were asked to determine problem in the scenario by researching the necessary subjects and existing knowledge. After the students had finished researching the subjects, they started to solve the problem. At this point, the students were presented with the first concept cartoon.



First Concept Cartoon **Second Concept Cartoon**

After the students solved the problem in the first session, the second session started and the following scenario was presented to the students. After this was done, the learning process was carried out, similar to the first session, and the following second concept cartoon was presented to the students.

Özge, who liked train journeys by train, became exhausted from the heat. She decided to look out the window both to become cooler and to watch the railway. She looked at the railway with admiration since, amongst the trees, the railway seemed to be very beautiful. However, when she looked at it carefully, she realized that the railway curved in some places. Özge, who knew that the railway was made of iron, did not understand how rough matter, like iron, was able to warp.

The students discussed the problem by sharing, through concept cartoons, their opinions with friends. Through co-operation, they explained their opinions and solved the problem by means of reasoned study. In this process, the teachers were the tutors and the students solved the problem by self-directing their learning and inquiries.

4. The Effects on Students of Concept Cartoons assisted Problem Based Learning

As a result of the effects, on students, of the concept cartoons assisted problem based learning process, semi-structured interviews were carried out with them. Their views were recorded with a tape recorder and, then, written up by the researchers. Each student was asked the question: "What do you think were the effects on you of the concept cartoons assisted problem based learning method?" All the students stated positive effects of the so-called method. The effects, on students, of the concept cartoons assisted problem based learning method were that more notice was taken of the students' opinions. This could be summarized as follows.

The lesson was entertaining lesson: the students stated that, with the so-called method, lessons were pleasant and entertaining. Some students stated similar opinions. These opinions were: "It was entertaining. Lessons went well"; "We both learned and had fun"; "We learned by making fun". Based on these opinions, it could be said that, with the concept cartoons assisted problem based learning method, the students were able to learn by having fun.

Some interviewed students indicated the reasons for their answers. These answers were: "It provided for lessons to be pleasant. I liked it very much. Because, we solved the problem and speeches were pleasant."; "Lessons were

pleasant. Sometimes we get bored by writing in the lessons. Scenario provided for learning without writing. This was both entertaining and useful for learning." ; and "Shapes and paintings included in modules. So lessons were entertaining." According to the so-called views about concept cartoons assisted problem based learning, it could be said that students found this method, of solving problems, entertaining because speeches were included in caricatures and they thought more about the shapes and paintings than the writing included in modules .

Active participation in learning process: In the course of the interviews, students stated that they were active in the learning process and discussed, each other, the concept cartoons assisted problem based learning method. Students presented their views about the activities in the so-called learning process. These opinions were: "We discussed with our friends"; "I participated in lessons less previously. But, with this method since everybody stated their views about subject, I participated in lessons mostly."; "I paid attention in the course of lessons. I participated in lessons actively. Since lessons were entertaining, I said everything that came to my mind"; "I participated mostly in lessons. I discussed with my friends."; "I liked method since we shared our views about subjects with our friends."

Based on the students' responses, it could be said that students participated in lessons actively because they stated their views on the learning process, discussed with each other; and shared their views with friends,

Meaningful and permanent learning: In the course of the interviews, students stated their views about meaningful and permanent learning; these were the most important aims of the learning process. Students presented views about learning well with concept cartoons assisted problem based learning. These opinions were: "This method helped me for learning well"; "This method provided for me to learn well. It was remarkable. I learned well with this method."; "This method helped me for understanding subjects well"; "I learned well. Because there were events in the scenario that we meet in our daily life."; and "I learned well, understood well by having fun. I used knowledge that I learned in the lessons in my daily life."

Students gave their views about learning permanently by using a concept cartoons assisted problem based learning method. These opinions were: "I learned well. This method helped me for remembering. I remembered everything after lessons."; "I remembered mostly. It helped me to learn the subjects that I didn't know. I learnt easily."; and "I could remember caricature in daily life since there were shapes and paintings in caricatures. And also since caricatures spoke and discussed with each other, I remembered well." Based on the students' views, it could be said that students could learn well and meaningfully, use the knowledge in their daily lives and, with a concept cartoons assisted problem based learning method, learn permanently.

5. Conclusion and Suggestion

This study gave the example of activity, in science and technology teaching, arising from the use of concept cartoons assisted problem based learning method. In addition, it presented the students' views about the application of this method. Based on the students' views, it was concluded that a concept cartoons assisted problem based learning method provided students with an opportunity to learn by having fun; to compare their opinions with each other; through discussion, to participate actively in lessons; and, as a result of the learning process, to learn meaningfully and permanently. In reviewing the literature, it was found that studies concluded that a problem based learning method provided for students to learn meaningfully and permanently (Hsieh and Knight, 2008; Chikotas, 2009); to participate actively in lessons; and share their ideas with each other (Chou and Chin, 2009; Schmidt et al., 2009; Goodman, 2010). By comparison from the literature review, studies indicated that concept cartoons provided opportunities for students to learn, by having fun (Ekici, Ekici and Aydın, 2007; Naylor and Keogh, 2008); and to learn well and permanently (Keogh and Naylor, 1999; Birişçi and Metin, 2010). Consequently, it could be said that concept cartoons assisted problem based learning method was an effective method for secondary students. It is thought, for different subjects in science courses, the activities, arising from the so-called method, will be able to develop and affect activities developed from variables such as students' learning; high order thinking skills; and motivation. These can be determined in new studies to be carried out.

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